9 a $3x - x > 13 + 8$

$2x > 21$

$x > 10\frac{1}{2}$

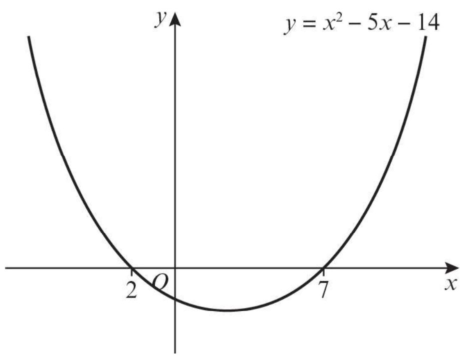
In set notation, the solution is

$\{x: x > \frac{21}{2}\}$

b $x^2 - 5x - 14 = 0$

$(x+2)(x-7) = 0$

$x = -2$ or $x = 7$



$x^2 - 5x - 14 > 0$ when $x < -2$

or $x > 7$

In set notation, the solution is

$\{x : x < -2\} \cup \{x : x > 7\}$

10 Multiplying out the brackets:

$x^2 - 5x + 4 < 2x - 8$

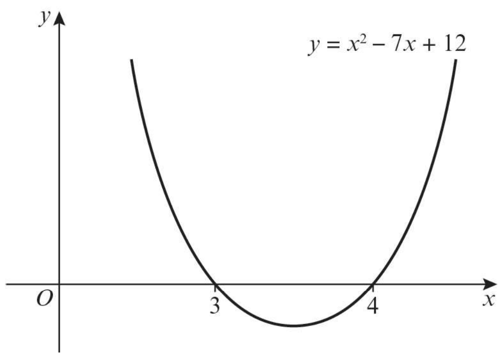
$x^2 - 5x - 2x + 4 + 8 < 0$

$x^2 - 7x + 12 < 0$

$x^2 - 7x + 12 = 0$

$(x-3)(x-4) = 0$

$x = 3$ or $x = 4$



$x^2 - 7x + 12 < 0$ when $3 < x < 4$

11 a $x^2 + x - 2 = 18$

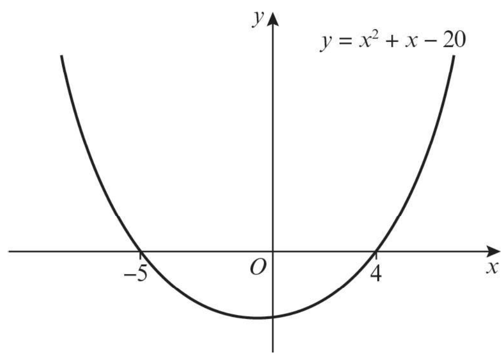
$x^2 + x - 20 = 0$

$(x+5)(x-4) = 0$

$x = -5$ or $x = 4$

b $(x-1)(x+2) > 18$

$\Rightarrow x^2 + x - 20 > 0$



$x^2 + x - 20 > 0$ when $x < -5$ or $x > 4$

In set notation, the solution is

$\{x : x < -5\} \cup \{x : x > 4\}$

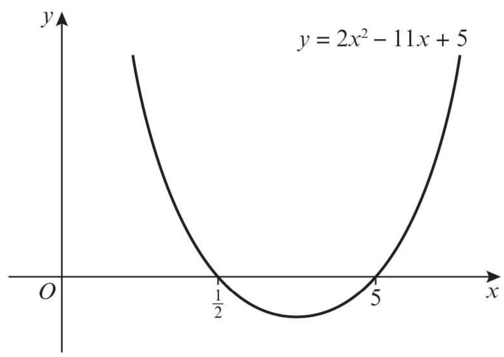
12 a $6x - 2x < 3 + 7$

$4x < 10$

$x < \frac{5}{2}$

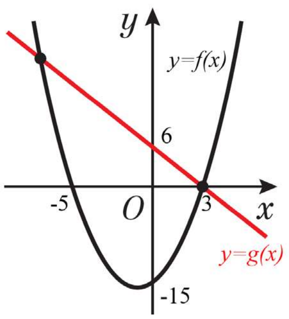
b $(2x-1)(x-5) = 0$

$x = \frac{1}{2}$ or $x = 5$



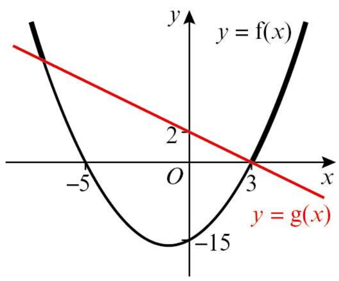
$2x^2 - 11x + 5 < 0$ when $\frac{1}{2} < x < 5$

16 a $y = x^2 + 2x - 15$
$y = (x + 5)(x - 3)$
$0 = (x + 5)(x - 3)$
$x = -5$ or $x = 3$
When $x = 0$, $y = -15$



b $x^2 + 2x - 15 = 6 - 2x$
$x^2 + 4x - 21 = 0$
$(x + 7)(x - 3) = 0$
$x = -7$ or $x = 3$
When $x = -7$, $y = 20$
When $x = 3$, $y = 0$
The points of intersection are $(-7, 20)$ and $(3, 0)$.

c



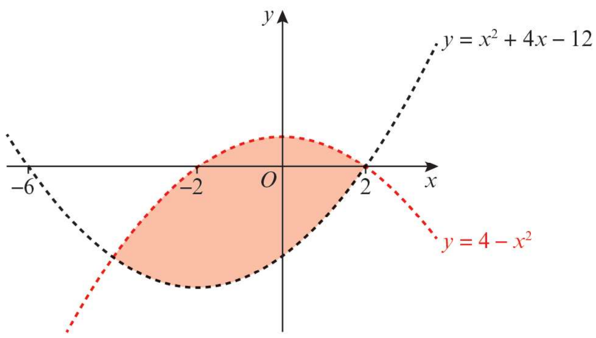
From the graph and the calculated points of intersection, the required values are
$x < -7$ or $x > 3$.

17 $2x^2 + 3x - 15 = 8 + 2x$
$2x^2 + x - 23 = 0$

$$x = \frac{-1 \pm \sqrt{185}}{4} = \tfrac{1}{4}\left(-1 \pm \sqrt{185}\right)$$

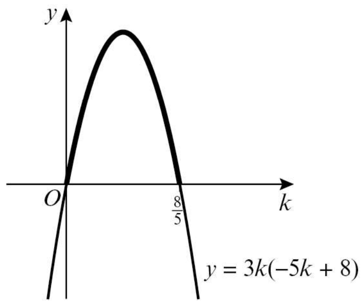
$$\tfrac{1}{4}\left(-1 - \sqrt{185}\right) < x < \tfrac{1}{4}\left(-1 + \sqrt{185}\right)$$

18 $y = x^2 + 4x - 12$
$x^2 + 4x - 12 = 0$
$(x + 6)(x - 2) = 0$
$x = -6$ or $x = 2$
$y = 4 - x^2$
$4 - x^2 = 0$
$(2 + x)(2 - x) = 0$
$x = -2$ or $x = 2$



Challenge

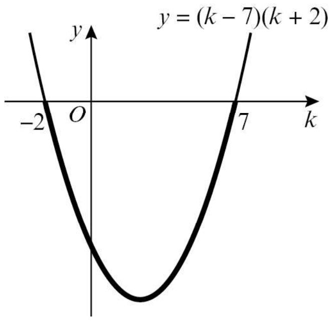
1 $2kx^2 + 5kx + 5k - 3 = 0$
Using the discriminant:
$b^2 - 4ac \geq 0$ for real roots.
$(5k)^2 - 4(2k)(5k - 3) \geq 0$
$25k^2 - 40k^2 + 24k \geq 0$
$-15k^2 + 24k \geq 0$
$3k(-5k + 8) \geq 0$
$3k(-5k + 8) = 0$
$k = 0$ or $k = \frac{8}{5}$



$0 < k \leq \frac{8}{5}$

2 $2x - k = 3x^2 + 2kx + 5$
$3x^2 + 2kx - 2x + 5 + k = 0$
$3x^2 + (2k - 2)x + 5 + k = 0$
If the line and parabola do not intersect then there are no solutions.

Using the discriminant:
$b^2 - 4ac < 0$
$(2k - 2)^2 - 4(3)(5 + k) < 0$
$4k^2 - 8k + 4 - 60 - 12k < 0$
$4k^2 - 20k - 56 < 0$
$k^2 - 5k - 14 < 0$
$k^2 - 5k - 14 = 0$
$(k - 7)(k + 2) = 0$
$k = 7$ or $k = -2$



The line and the parabola do not intersect in the interval $-2 < k < 7$